## REMARKS

The application has been reviewed in light of the Office Action dated September 13, 2007. Claims 1-15 are pending, with claim 1 being the sole pending claim in independent form.

Claims 1-3 and 7-15 were rejected under 35 U.S.C. § 102(b) as purportedly anticipated by Kusunoki et al. (US 2004/0207671 A1). Claims 4-6 were rejected under 35 U.S.C. § 103(a) as purportedly unpatentable over Kusunoki et al.

Applicant has carefully considered the Examiner's comments and the cited art, and respectfully submits that independent claim 1 is patentable over the cited art, for at least the following reasons.

This application relates to an image formation apparatus devised by applicant wherein discharge of ink drops is controlled in a novel and unobvious manner. In the improved image formation apparatus devised by applicant, one or more of the ink drops other than an ink drop that is not followed by any more of the ink drops in a given printing cycle (that is, the last ink drop) are discharged at an interval nearly equal to (n+1/2) x Tc, where n is an integer equal to or greater than 1, and Tc represents a resonance cycle of a pressurized ink chamber of the image formation apparatus, the interval being measured from when a corresponding preceding ink drop is discharged (claim 1 of the present application).

Kusunoki proposes an image recording apparatus including a head driving control apparatus that outputs a driving signal for driving a pressure generation part in a droplet discharging head to discharge plural ink droplets at a specific timing.

Such specific timing is stated in Kusunoki, [0114]-[0119], which was cited in the Office Action and is reproduced below:

> [0114] Next, a second embodiment of the head driving control apparatus of

the present invention will be described with reference to FIG. 11. In this embodiment, a large ink droplet is discharged by applying a plurality of driving pulses continuously in one driving period, wherein each driving pulse is a so-called "push and shoot" pulse for discharging an ink droplet by contracting the volume of the pressurizing chamber.

[0115] In this embodiment, the driving waveform generation circuit 77 generates and outputs a driving waveform Pv including a plurality of driving pulses shown in FIG. 11(a), and this driving waveform Pv is applied to the piezoelectric vibrator 52 that is a pressure generation part via the switch circuit 84. That is, the driving waveform Pv is formed by time-series four pulses Pa and Pb each used for discharging an ink droplet by contracting the volume of the pressurizing chamber in a driving period. Difference between the driving pulse Pa and the driving pulse Pb is only the falling time constant tf.

[0116] By applying the driving waveform Pv to the piezoelectric vibrator 52 as the driving signal P, driving pulses Pa, Pb are applied to the piezoelectric vibrator 52 continuously. The piezoelectric vibrator 52 extends by the driving pulses Pa and Pb, so that the volume of the pressurizing chamber 46 is decreased via the vibration plate 42. Therefore, ***an ink droplet is discharged for each of the driving pulses Pa and Pb, and the four ink droplets are integrated while they are lying so as to form a large ink droplet***, so that the large ink droplet is projected on a paper.

[0117] When the driving pulses are applied to discharge an ink droplet by contracting the volume of the pressurizing chamber 46, the pressure in the pressurizing chamber 46 changes as shown in FIG. 11(b). Assuming that wave parameters of the driving pulse Pa (Pb) are a rising time constant tr, a pulse width Pw, a falling time constant tf, and a pulse interval td, the waveform parameters are set such that a following equation (1) holds true, wherein ***Ts is the resonance period of the pressure vibration of the pressurizing chamber*** 46.

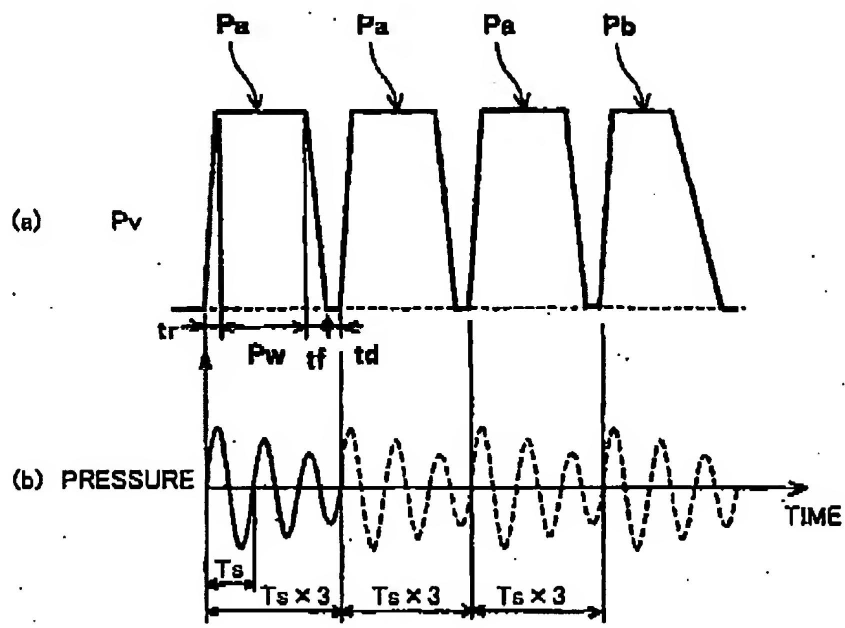
$$tr+Pw+tf+td=n \times Ts \qquad (1)$$

[0118] (n is an integer that is no less than 1)

[0119] That is, the sum of the waveform parameters (=tr+Pw+tf+td) is set to be n times as large as the ink resonance period Ts. Accordingly, the timing for discharging an ink droplet (at the time of rise of each pulse) almost agrees with the timing when the pressure in the pressurizing chamber 46 becomes positive. Thus, the ink droplet discharging speed Vj can be increased, so that a plurality of ink droplets are integrated while flying with reliability to form a large droplet, and the large ink droplet can be projected on the paper.

Figs. 11a and 11b of Kusunoki are reproduced below:

FIG.11




Thus, in the image recording apparatus proposed by Kusunoki, the timing of discharge between plural ink droplets is nxTs (with Ts being the resonance period of the pressure vibration of the pressurizing chamber).

It is contended in the Office Action that the timing of nxTs (with Ts being the resonance period of the pressure vibration of the pressurizing chamber) proposed in Kusunoki is nearly equal to (n+1/2) x Tc as provided by the claimed subject matter of the present application.

Applicant respectfully submits that this contention is false, that is, nxTs in Kusunoki is <u>NOT</u> nearly equal to (n+1/2) x Tc.

As discussed in the application, applicant determined through substantial investigation that it was desirable to have a timing for discharge of multiple droplets (that merge before reaching a print target medium) in which the interval of at least one droplet other than the last

droplet is (n+1/2) x Tc, to allow the residual pressure vibration to be canceled or suppressed. The investigation revealed that droplets that have an interval of n x Tc do not allow the residual pressure vibration to be canceled or suppressed.

As discussed in the application, for example, in connection with Figs. 7 (drive pulse in a first embodiment) and 8 (drive pulse in first comparative example) and Figs. 9 (experimental results from the first embodiment) and 10 (experimental results from the first comparative example), when all of the droplets were discharged at an interval of n x Tc (in first comparative example), ink drop discharge became unstable (from accumulation of residual pressure causing nozzle to become dirty) when the driver voltage was raised to 22V. In contrast, in the first embodiment, wherein each of the interval between the first droplet and the second droplet as well as the interval between the second droplet and the third droplet was (n+1/2) x Tc (that is, 1.5Tc), the discharge remained stable even when the driver voltage was raised to 24V.

Therefore, contrary to the contention in the Office Action, the difference between (n+1/2) x Tc and n x Tc is a substantial difference, leading to very different results.

Further, applicant submits that one skilled in the art would understand that a difference in timing of 0.5Tc is not insubstantial and that (n+1/2) x Tc and n x Tc are not nearly equal.

Therefore, applicant maintains that Kusunoki does not teach or suggest the subject matter of claim 1 of the present application.

Accordingly, applicant submits that independent claim 1 and the claims depending therefrom are patentable over the cited art..

In view of the remarks hereinabove, Applicant submits that the application is now in condition for allowance. Accordingly, Applicant earnestly solicits the allowance of the application.

If a petition for an extension of time is required to make this response timely, this paper should be considered to be such a petition. The Patent Office is hereby authorized to charge any fees that are required in connection with this amendment and to credit any overpayment to our Deposit Account No. 03-3125.

If a telephone interview could advance the prosecution of this application, the Examiner is respectfully requested to call the undersigned attorney.

Respectfully submitted,

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